

AD-A054 299

CONSTRUCTION ENGINEERING RESEARCH LAB (ARMY) CHAMPAI--ETC F/G 5/1
PRELIMINARY INVESTIGATIONS OF RISK SHARING IN CONSTRUCTION CONT--ETC(U)
APR 78 C A ERIKSON, M J O'CONNOR, O E ROOD

UNCLASSIFIED

| OF |
AD
A054299

NL



END
DATE
FILED
6-78
DDC

FOR FURTHER THAN

B.S.

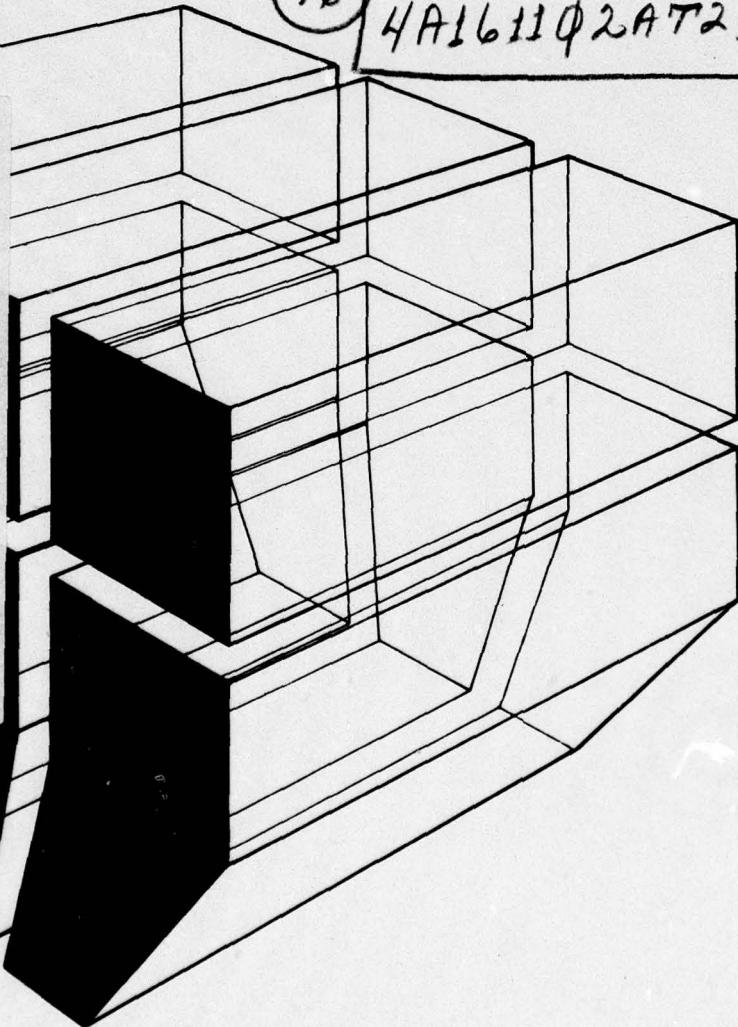
construction
engineering
research
laboratory

INTERIM REPORT P-88
April 1978

Risk Assignment in Military Construction

AD A 054299

AU NO.
DDC FILE COPY



405 279

Approved for public release; distribution unlimited.

(6) PRELIMINARY INVESTIGATIONS OF RISK SHARING
IN CONSTRUCTION CONTRACTS

(14) CERL-IR-P-88

(16)

4A161102AT23

(17)

A2

(10)

by
Carl A. Erikson,
Michael J. O'Connor
Omar E. Rood, Jr.

(11)

Apr 78

(12)

74 P.

D D C

REF ID: A651147
MAY 26 1978
D

W W
C E R L

The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official indorsement or approval of the use of such commercial products. The findings of this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

**DESTROY THIS REPORT WHEN IT IS NO LONGER NEEDED
DO NOT RETURN IT TO THE ORIGINATOR**

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CERL-IR-P-88	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) PRELIMINARY INVESTIGATIONS OF RISK SHARING IN CONSTRUCTION CONTRACTS		5. TYPE OF REPORT & PERIOD COVERED INTERIM
7. AUTHOR(s) Carl A. Erikson Michael J. O'Connor Omar E. Rood, Jr.		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS CONSTRUCTION ENGINEERING RESEARCH LABORATORY P.O. Box 4005 Champaign, IL 61820		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A161102AT23-A2-005
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE April 1978
		13. NUMBER OF PAGES 72
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Copies are obtainable from National Technical Information Service Springfield, VA 22151		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) construction contract risk firm-fixed-price		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents the results of an investigation to delineate the current assignment of risk between the owner and the contractor in typical Corps of Engineers firm-fixed-price construction contracts. A working definition of risk is formulated. Research performed to date is summarized for the benefit of future researchers in this area. Included is a summary of existing construction risk categorization schemes and a comprehensive reading list of literature available in the construction risk area.		

~~SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)~~

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

FOREWORD

This research was conducted for the Directorate of Military Construction, Office of the Chief of Engineers (OCE), under Project 4A161102AT23, "Basic Research in Military Construction"; Task A2, "Military Construction Management"; Work Unit 005, "Risk Assignment in Military Construction." The applicable QCR is 1.01.018.

The work was performed by the Facility Systems Division (FS), U.S. Army Construction Engineering Research Laboratory (CERL), Champaign, IL. The Principal Investigator was Mr. Michael J. O'Connor, and Mr. Carl A. Erikson was the Associate Investigator. Mr. E. A. Lotz is Chief of FS.

COL J. E. Hays is Commander and Director of CERL and Dr. L. R. Shaffer is Technical Director.

ACCESSION FOR	
RTIS	White Section <input checked="" type="checkbox"/>
RRG	Buff Section <input type="checkbox"/>
UNANNOUNCED <input type="checkbox"/>	
JUSTIFICATION.....	
BY.....	
DISTRIBUTION/AVAILABILITY CODES	
DIST.	AVAIL. AND/OR SPECIAL
A	

CONTENTS

DD FORM 1473 FOREWORD	1 3
1 INTRODUCTION	5
Background	
Objective	
Approach	
Scope	
2 DEFINING RISK	7
Working Definition of Risk	
Statistical Aspects	
3 CURRENT RISK ASSIGNMENT.	10
4 EXISTING CATEGORIZATION SCHEMES AND IDENTIFICATION OF RISK.	11
5 ASSESSMENT OF RISK-SHARING POTENTIAL	15
Determination of Contingencies by Contractors	
Contractual Risk Versus Construction Risk	
Advantages and Disadvantages of the Risk-Sharing Approach	
6 CONCLUSIONS AND RECOMMENDATIONS.	19
REFERENCES	20
APPENDIX A: Delineation of Risk Assignment Between Owner and Contractor	22
APPENDIX B: Comprehensive Bibliography	68

PRELIMINARY INVESTIGATIONS OF RISK SHARING IN CONSTRUCTION CONTRACTS

1 INTRODUCTION

Background

Contracts are designed to fix obligations between two or more parties. In construction contracts, the owner traditionally avoids obligations through the use of exculpatory and hold-harmless clauses. Doing so, however, may not be in the owner's best interests, considering the fact that he* is the one who can select the type and provisions of the contract. When contractors are obliged to assume the risk, they include in their bids contingency costs for events that often do not actually occur. Litigation resulting from such construction contracts not only is costly and time consuming but has frequently resulted in interpretations favoring the contractor. However, owners who are willing to share risk with a contractor in an attempt to obtain smaller contingencies and thus reduce the expected cost for a construction project find that no systematic approach has been developed to guide them in selecting a risk-allocation strategy.

Objective

The objective of this study was to develop an approach to risk allocation in construction contracts. The purpose of this report is to summarize the work completed to date and to provide guidance for future research on this topic.

Approach

The approach of this study was to:

1. Identify the risks in the construction process
2. Delineate the current risk assignment
3. Develop a risk-categorization scheme
4. Synthesize this information to develop a comprehensive, systematic approach to allocating risk in construction contracts

* The male pronoun is used throughout this report to represent both genders.

5. Provide recommendations for further work on this topic.

Steps one and two had been completed and step three was underway when this report was prepared. The report analyzes the risks identified in the first step of this study to delineate the current division of risk between the owner and contractor. This information is intended to serve as a foundation for categorizing those risks and for subsequently developing an approach to risk allocation. The report also formulates a working definition of risk and reviews existing risk-categorization schemes. Recommendations are provided to assist future research. A comprehensive list of existing literature is provided in Appendix B to aid future researchers.

Scope

The scope of this study was limited to the areas of procurement strategy, selection of contract type and provisions, and administration of construction contracts. The results are applicable to the general types of construction in which the Corps of Engineers is involved.

2 DEFINING RISK

Although the literature contains several articles which address the problem of risks in construction, no attempt is usually made to clarify the meaning of the term *risk*. This chapter will therefore present a working definition of risk and elaborate on some of the statistical aspects of the definition.

Working Definition of Risk

Risk: An exposure to economic loss or gain arising from involvement in the construction process.

Risk is further characterized by the following observations:

1. The frame of reference for considering the loss or gain may be relative to either the anticipated cost associated with the risk exposure or to an ideal cost based on optimal conditions.
2. Risk exposures are inherent in a construction project, and the risks are allocated to the parties who become involved in the project. Events occur which may result in a loss or gain being realized relative to the anticipated or ideal cost.
3. Risks may be considered from the viewpoint of different parties--for example, the owner, designer, contractor, subcontractors, suppliers, insurers, sureties, or financiers.
4. It is possible to describe the following variables:
 - a. Frequency of losses or gains
 - b. Severity of losses or gains
 - c. Variability of losses or gains.

Statistical Aspects

Consideration of alternative risk-allocation strategies requires an evaluation of individual risks in the construction process, emphasizing those risks which are deemed most important. This section will present criteria to facilitate the identification of such risks, using Figure 1 as a framework for discussion.

Statement four in the preceding definition of risk mentions the frequency, variability, and severity of losses or gains. These concepts

are illustrated in Figure 1, which shows a hypothetical assessment of the risks arising from changes in excise taxes and from floods.

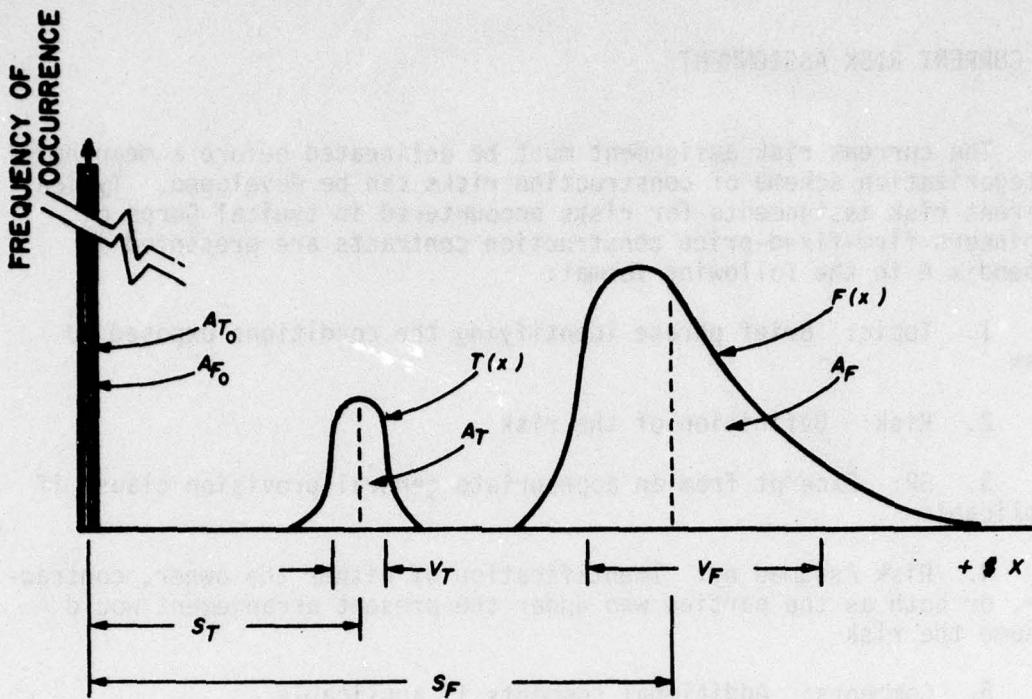
For this hypothetical example, assume there is a 5 percent chance that an excise-tax change which increases costs will go into effect. The area $A_T = 0.05$, and there is a 95 percent chance that the change will not occur and costs will not be affected. Hence, the area $A_{T_0} = 0.95$. Note that $A_T + A_{T_0} = 1$. Given that a change in excise taxes does occur, it can be estimated that the effect on costs will be of some severity or magnitude, S_T --for example, \$100 or \$1,000,000. This information, along with that on the frequency of occurrence for an excise-tax change, will indicate how much attention this factor warrants. Also, the variability, V_T , indicates the uncertainty involved in predicting the effect on costs if an excise-tax change occurs.

For comparison, assume that a frequency distribution for floods indicates there is a 40 percent chance that a flood which affects costs will occur. Hence $A_F = 0.4$ and $A_{F_0} = 0.6$. From Figure 1 it is apparent that:

1. $A_F > A_T$, indicating that it is much more probable that a flood which affects costs will occur than that an excise-tax change affecting costs will occur.
2. $S_F > S_T$, indicating that if both a flood and an excise-tax change occur, it is likely that the flood will involve higher costs.
3. $V_F > V_T$, indicating that if both a flood and an excise-tax change affecting costs occur, the probable costs resulting from the flood are much more dispersed.

Summarizing, consideration must be given to:

1. The frequency of occurrence of an event which affects costs
2. The severity of the effect on costs if the event occurs
3. The variability of the distribution of costs if the event occurs.



$T(x)$ = frequency distribution function given that an excise-tax change affecting costs occurs

A_T = the area under the curve $T(x)$, representing the probability that an excise-tax change will affect costs

A_{T_0} = the area at the origin, representing the probability that no change in excise taxes affecting costs occurs. Note: $A_T + A_{T_0} = 1$

S_T = given that a change in excise taxes affecting costs occurs, S_T indicates the severity or size of the dollar costs that may be incurred.

V_T = given that a change in excise taxes affecting costs occurs, V_T indicates the variability of dollar costs that may result. It is a measure of dispersion or central tendency.

$F(x)$, A_F , A_{F_0} , S_F , and V_F are defined similarly except that they represent floods. Note: $A_F + A_{F_0} = 1$

Figure 1. Hypothetical risk assessment comparison for an excise-tax change and for a flood.

3 CURRENT RISK ASSIGNMENT

The current risk assignment must be delineated before a meaningful categorization scheme of construction risks can be developed. Typical current risk assignments for risks encountered in typical Corps of Engineers firm-fixed-price construction contracts are presented in Appendix A in the following format:

1. Topic: Brief phrase identifying the conditions exposed to risk
2. Risk: Definition of the risk
3. GP: Excerpt from an appropriate general provision clause if applicable
4. Risk Assumed by: Identification of either the owner, contractor, or both as the parties who under the present arrangement would assume the risk
5. Comments: Additional comments if applicable.

4 EXISTING CATEGORIZATION SCHEMES AND IDENTIFICATION OF RISK

Existing categorizations were reviewed as a foundation for developing a categorization scheme for construction risks. Eight publications which present such schemes will be discussed briefly. The uncited references section (pp 20 and 21) lists additional publications containing uncategorized risk listings.

Mason¹ has classified risks into the areas of:

1. Nonperformance
2. Situation changes
3. Cost of dispute settlements
4. Liability losses
5. Damage to the project during construction.

Mason formulated four methods for managing these risks:

1. Risk avoidance
2. Risk abatement
3. Risk retention
4. Risk transfer.

Mason's work concentrates on the traditional bonding and insurance areas, which correspond to the nonperformance and liability-loss classifications, respectively. The viewpoint is primarily that of the owner, and the information presented is intended to aid in the selection of contract provisions.

Shafer² discusses the use of a risk analysis approach for cost estimating. He categorizes risk elements as follows:

¹ G. E. Mason, *A Quantitative Risk Management Approach to the Selection of Construction Contract Provisions*, Technical Report No. 173 (The Construction Institute, Department of Civil Engineering, Stanford University, April 1973), pp 26-61.

² S. L. Shafer, "Risk Analysis for Capital Projects Using Risk Elements," *Transactions of The American Association of Cost Engineers* (1973), pp 218-223.

1. Design elements
 - a. Engineering changes
 - b. Field changes
2. Contingency elements
 - a. Labor
 - b. Other job conditions
 - c. Pricing.

Johnson and Rood³ divide contractor risks into the following categories:

1. Business risks
 - a. Capital investments
 - b. Cash flow
 - c. Profitability
2. Project risks
 - a. Contractual specificity
 - b. Project cost estimate
3. Operations risks
 - a. Management control
 - b. Operations costs
 - c. Labor equality
 - d. Construction performance.

The viewpoint of their work is that of the owner, and the objective is to provide information useful in construction contract negotiations.

³ J. Johnson and O. E. Rood, Jr., *Elements of a Fair and Equitable Profit Determination for Construction Contract Negotiations, Draft Report* (U.S. Army Construction Engineering Research Laboratory [CERL], 1977).

Frisby⁴ classifies risks as follows:

1. Entrepreneurial risks
2. Project risks
3. Resources to be managed
4. External factors.

Frisby's work is apparently intended to be used at the management level of a construction firm.

Kraemer⁵ considers risk assessment from a viewpoint more typical of the aerospace, electronic, or tooling industries rather than of the construction industry. Kraemer considers an appropriate categorization scheme to be:

1. Cost risk
2. Schedule risk
3. Technical risk.

Gates⁶ places construction contracting contingencies into four categories:

1. Mistakes
2. Subjective uncertainties
3. Objective uncertainties
4. Chance variations.

Gates considers risks which necessitate the use of contingencies from the viewpoint of a contractor estimating costs for a project.

⁴ T. M. Frisby, "Risk Management," presented at the U.S. Army Engineer District Mobile Area and Resident Engineers Conference (21-23 July 1976), pp I-1-I-17.

⁵ G. T. Kraemer, "Meaningful Risk Assessment," *Transactions of The American Association of Cost Engineers* (1976), pp 127-132.

⁶ M. Gates, "Bidding Contingencies and Probabilities," *Journal of The Construction Division, ASCE*, Vol 97, No. CO2, Proc. Paper 8524 (November 1971), pp 277-303.

Marshall⁷ considers three major factors to be important in formulating a measure of contractor risk arising from cost variations:

1. Cost variability due to real world uncertainty
2. Contract structure (including contract type)
3. Contractor's utility for money.

Benson and Colwell⁸ consider risks from the point of view of an owner in the process of selecting the type of contract to be used for a construction project. They define three categories for evaluating the assumption of risk:

1. Factors related to the day-to-day operation of the construction effort
2. Resources necessary to construct the project which are beyond the control or influence of the contractor
3. Factors that are a function of or related to the work or the work site.

The eight references cited above reflect widely differing views of risk categorization. A more comprehensive and more detailed scheme will be developed in the next phase of this work unit, incorporating ideas from existing literature and new developments.

⁷ C. W. Marshall, "Quantification of Contractor Risk," *Naval Research Logistics Quarterly*, Vol 16, No. 4 (December 1969), pp 531-541.

⁸ L. Benson and G. Colwell, *Contract Type Selection Guide for Construction Contracts*, Draft Report (CERL, 1977).

5 ASSESSMENT OF RISK-SHARING POTENTIAL

Determination of Contingencies by Contractors

Utility theory suggests that risk sharing should not be done on the basis of expected monetary value. If risks were allocated between a large owner such as the Federal Government and a contractor on an expected monetary value basis, it should make no difference in expected costs whether the owner or the contractor assumed the risk. For instance, assume there is a probability of 0.1 that a flood will occur and cause \$1,000,000 in damage to a construction project despite any possible precautions. On the basis of expected monetary value, it should make no difference whether the contractor or the owner assumed this risk; if the contractor assumed the risk, he would charge the owner $0.1 \times \$1,000,000$ or \$100,000 to cover the risk, while if the owner assumed the risk, he would similarly add \$100,000 to the expected cost of the project. The consequences if the flood did occur, however, could be quite different in the two cases. If the contractor had assumed the risk, the additional cost of \$900,000 above the expected \$100,000 might be a catastrophic loss resulting in bankruptcy or at least seriously impairing the contractor's ability to operate. The effects on the owner (the Federal Government) if it had assumed the risk would not be nearly so serious.

Because of the possibility of catastrophic loss, contractors do not appear willing to assume large risks on the basis of expected monetary value. They tend to include a sufficient contingency above and beyond the expected value of the loss so that even if the loss occurs the cost will not be catastrophic. For example, assume that the contractor could withstand a \$200,000 flood loss but that a \$300,000 loss would put him out of business. He might then be unwilling to assume the risk for less than \$800,000, thus limiting his maximum loss to \$200,000. In other words, the contractor in this case has a preference for particular dollar outcomes which is not in proportion to their dollar amounts. To reflect this risk aversion preference, utility theory assigns utility values to various dollar amounts by analyzing the decision-maker's preference for outcomes in a series of simple uncertainty lotteries. Whereas the contractor might have gone bankrupt in the short run if a flood occurred, a large owner might be better able to sustain a large loss on a particular project because the losses should average out in the long run over several projects and approach an expected value. His utility curve may approach that derived on an expected monetary value basis.

Contractual Risk Versus Construction Risk

Two areas show promise for further research on risk sharing in construction contracts. They can be classified as contractual risk and construction risk. Contractual risk results from lack of contract clarity, the absence of perfect communication between the parties to the construction process, and problems of timeliness in contract administration. Contractual risk exposes both the owner and contractor to uncertainties which increase the cost to both parties. Such risks are not risks to be shared but rather those which should be reduced by better management through improved contract clarity and contract administration on the part of the owner. It is thought that the costs of reducing contractual risk may be minimal in comparison to the costs of the uncertainties, inefficiencies, and delays which contractual risk creates.

Construction risks, on the other hand, are risks inherent in the project itself. Whereas contractual risks arise primarily from the interaction between the many different parties in the construction process (e.g., the owner, architect/engineer, contractor, subcontractors, surety, insurers, regulatory agencies, and suppliers), construction risk would be present even if only one company with perfect internal communication and cooperation performed all of the necessary functions. Construction risk may result from such factors as weather, differing site conditions, acts of God, or resource availability. Although construction risks may be reduced somewhat, they are managed primarily by assigning them to one or more of the parties to the construction process. This assignment should consider such factors as comparing the differing utility functions of each of the parties, maintaining contractor incentives, and determining which party could best control the risk or influence the severity of the loss given an occurrence.

Advantages and Disadvantages of the Risk-Sharing Approach

Because of differing utility functions between owners and contractors, it may be beneficial for a large owner to assume more of the risk, thereby reducing contingencies and increasing competition from smaller contractors who would not be able to sustain a large loss. Although the easiest way to write a contract is to state that the contractor will assume all of the risk, there are several practical limitations which further support the risk-sharing approach:

1. Court interpretations of exculpatory clauses frequently find them unenforceable.
2. The owner and contractor may both lose. If the contractor gambles on a risk and goes bankrupt on a job, both the owner and the

contractor lose because of delays and litigation. Such a situation could perhaps be averted if the owner assumed more of the risk.

3. Competition is reduced. Smaller contractors who would otherwise be qualified and competitive may not be able to bid competitively with a reasonable assurance of not incurring a catastrophic loss if some of the uncertain events occur and produce cost overruns. Large, qualified contractors may not bid because they realize "gambling" contractors or those who do not realistically appraise the risk are bidding against them. The only way the contractor can match such bids and still make a profit is if everything goes perfectly or if he is contemplating litigation from the start.

4. Because of differing utility functions, the owner may be better able to assume more of the risk. The owner may be paying more in contingency costs than they are really worth to him because the contractor's contingency reflects a different utility function from the owner's.

5. If the uncertain events do not occur, the contractor realizes a windfall profit at the owner's expense.

An alternative to the approach of assigning all the construction risk to the contractor is for the owner to share it with the contractor. Doing so may stimulate increased competition and reduced contingencies. It would favor contractors who are good constructors and good risk managers rather than good claims artists or gamblers. The public may then be able to obtain more for its construction dollar through increased competition from competent contractors and by receiving bids which include fewer contingencies based on contractors' utility functions.

Possible problems in implementing this approach are:

1. Detailed contract clauses are required. Clauses assigning the risk must be more detailed than broad exculpatory clauses passing all risks to the contractor. The clauses must identify and define the risks and establish decision criteria to be used in determining when an uncertain event occurs for which the owner will assume responsibility. For example, weather effects may be determined by the amount of rainfall in a given period, taking into account such factors as individual storm effects, cumulative effects, and deviation from normal rainfall.

2. Contractor incentives must be provided. When risk is shared, proper incentives must be present to maintain efficient contractor performance. A most undesirable situation would be one in which the contractor sends his employees home whenever the sky is overcast because he profits greatly from loosely interpreted rain delays.

3. The contractor may be a better risk manager. When the contractor assumes all of the risk he also has the most incentive to use his experience and ingenuity to reduce the risk through proper management. He must be given incentives to do so.

4. In a risk-sharing case, the bid submitted by the contractor should contain a smaller contingency. Since it is highly likely that at least some of the uncertain events will actually occur, some additional payments will have to be made to the contractor. Public apprehension may result when these apparent cost overruns and time extensions are incurred.

5. If the contractor's perception of his risk does not change, the owner will not receive a more favorable bid. The contractor's perception of the change in risk allocation will depend upon several factors influencing his interpretation of the risk-allocation clause:

- a. The intent of the persons selecting the clause
- b. The interpretation of the owner's field representatives
- c. The interpretation of the owner's personnel responsible for approving additional funds.

If the objective--receiving bids containing smaller contingencies --has not been clarified to the owner's field representatives and comptroller, their actions may cause the contractor to perceive no change. In this case, costly and lengthy litigation will probably result.

6 CONCLUSIONS AND RECOMMENDATIONS

The approach used in the early phases of this study still appears to be appropriate. This report has summarized the progress to date and is intended to aid further research in the construction-risk area.

Because of contractors' risk-aversion preferences and their fear of catastrophic losses, their formulations for contingency are better explained by utility theory than on the basis of expected monetary value. Large owners may be paying more in contingencies than it is worth to them because contingencies reflect the utility curve of the contractor rather than that of the owner.

Contractual risk, which arises primarily from relationships with other parties in the construction process, and construction risk, which is inherent in the work itself, are both perceived by the contractor as being capable of influencing his costs. Contractual risk can be reduced. Construction risk can also be reduced somewhat but must be assigned to one of the parties.

Potential implementation problems for a risk-sharing approach are that contract clauses must be more detailed, contractor incentives for efficient performance must be maintained, and the public may incorrectly perceive apparent cost overruns. Also, the success of risk sharing is dependent upon the contractor's perception that his risk exposure has been changed. These problems appear minor in comparison to the potential benefits of lower contingencies and increased competition.

CITED REFERENCES

- Benson, L., and G. Colwell, *Contract Type Selection Guide for Construction Contracts*, Draft Report (U.S. Army Construction Engineering Research Laboratory [CERL], 1977).
- Frisby, T. N., *Risk Management*, presented at the U.S. Army Engineer District Mobile Area and Residents Engineering Conference (21-23 July 1976), pp I-1-I-17.
- Gates, M., "Bidding Contingencies and Probabilities," *Journal of the Construction Division, ASCE*, Vol 97, No. C02, Proc. Paper 8524, (November 1971), pp 277-303.
- Johnson, J., and O. E. Rood, Jr., *Elements of a Fair and Equitable Profit Determination for Construction Contract Negotiations*, Draft Report (U.S. Army Construction Engineering Research Laboratory [CERL], 1977).
- Kraemer, G. T., "Meaningful Risk Assessment," *Transactions of The American Association of Cost Engineers* (1976), pp 127-132.
- Marshall, C.W., "Quantification of Contractor Risk," *Naval Research Logistics Quarterly*, Vol 16, No. 4 (December 1969), pp 531-541.
- Mason, G. E., *A Quantitative Risk Management Approach to the Selection of Construction Contract Provisions*, Technical Report No. 173 (The Construction Institute, Department of Civil Engineering, Stanford University, April 1973), pp 26-61.
- Shafer, S. L., "Risk Analysis for Capital Projects Using Risk Elements," *Transactions of The American Association of Cost Engineers* (1974), pp 218-223.

UNCITED REFERENCES

- Baldwin, J. R., J. M. Manthei, H. Rothbart, and R. B. Harris, "Causes of Delay in Construction," *Journal of the Construction Division, ASCE*, Vol 97, No. C02, Proc. Paper 8501 (November 1971), pp 177-187.
- Benjamin, N. B. H., *Competitive Bidding for Building Construction Contracts*, Technical Report No. 106 (The Construction Institute, Department of Civil Engineering, Stanford University, June 1969).

UNCITED REFERENCES (Cont'd)

- Carr, R. I., "Paying the Price for Construction Risk," *Journal of the Construction Division, ASCE*, Vol 103, No. C01, Proc. Paper 12827 (March 1977), pp 153-161.
- Fox, G. A., "Subsurface Construction Contracts--A Contractor's View," *Journal of the Construction Division, ASCE*, Vol 100, No. C02, Proc. Paper 10608 (June 1974), pp 153-158.
- Gates, M., "Bidding Strategies and Probabilities," *Journal of the Construction Division, ASCE*, Vol 93, No. C01, Proc. Paper 5159 (March 1967), pp 75-107.
- Vergara, A. J. and L. T. Boyer, "Portfolio Theory: Applications in Construction," *Journal of the Construction Division, ASCE*, Vol 103, No. C01, Proc. Paper 12773 (March 1977), pp 23-38.
- Vergara, A. J. and L. T. Boyer, "Probabilistic Approach to Estimating and Cost Control," *Journal of the Construction Division, ASCE*, Vol 100, No. C04, Proc. Paper 11021 (December 1974), pp 543-552.

APPENDIX A:

DELINERATION OF RISK ASSIGNMENT
BETWEEN OWNER AND CONTRACTOR

INDEX

<u>No.</u>	<u>Risk Title</u>	<u>GPs Noted</u>	<u>Page</u>
1	Limited Time and Funding for Design and Subsurface Investigation	-	25
2	Design Errors: Conflicts, Omissions, Interferences	GP-3	26
3	Constructibility: Innovative Versus Traditional Design	GP-3	27
4	Plans and Specifications Materials and Installed Equipment Contradictory Clauses Defective Specifications	GP-9 GP-2 GP-3	28
5	Limited Contractor Time for Bid Preparation and Site Investigation	{ GP-13 GP-48	30
6	Estimating, Planning and Scheduling, and Bid Preparation Errors Judgment Errors, Interpretation Errors, Omissions Mistake	- -	31
7	Estimating, Planning and Scheduling Forecasts Distance to Project from Contractor's Home Office Uncertainty in Productivity Forecasts Uncertainty in Scheduling	GP-13 - -	32
8	Competitive Environment Local Construction Economy Number of Bidders	- -	34
9	Contractor's Values	-	35
10	Contract Administration Owner's Timely Performance of Decision Making and Approvals Owner's Versus Contractor's Perception of Contractor's Responsibilities	{ GP-9 GP-15 -	36

<u>No.</u>	<u>Risk Title</u>	<u>GPs Noted</u>	<u>Page</u>
11	Degree of Inspection for Compliance Familiarity with Interpretation of Specifications Familiarity with Inspection Procedures	- GP-10 GP-41	37
12	Changes in Owner's Requirements for Facility	GP-3	38
13	Shop Drawings	GP-15	39
14	Changes in Costs	-	40
15	Basis for Determination of Costs	-	41
16	Disputes	GP-6 GP-19	42
17	Termination for Default, Damages for Delay, and Time Extensions	GP-5	43
18	Financial Aspects Cash Flow: Progress Payments, Re- tainages, and Separate Payment for Mobilization and Demobilization Costs Continuation of Funding	GP-7 GP-18	44
19	Permits, Licenses, and Patents Permits and Licenses Patents	GP-12 GP-21	46
20	Taxes	GP-31	47
21	Additional Bond Security	GP-22	48
22	Liability Losses	GP-12	49
23	Damages and Delays to Project During Construction	GP-5 GP-12	50
24	Contractor Failure to Enter Into Contract	-	51
25	Nonpayment of Creditors	-	52
26	Interferences from Acts of Owner Other Contracts	GP-5 GP-14	53

<u>No.</u>	<u>Risk Title</u>	<u>GPs Noted</u>	<u>Page</u>
	Use and Possession Prior to Completion Suspension of Work	GP-16 GP-17	
27	Differing Site Conditions	GP-4	55
28	Normal Weather Variations and Seasonality Effects	-	56
29	Environmental Protection Environmental Litigation Environmental Regulations	GP-73 GP-62	57
30	Health and Safety	{ GP-12 GP-55	59
31	Labor Availability and Quality Strikes Socioeconomic	- GP-5 GP-25 GP-28 GP-32 GP-33 GP-34 GP-35 GP-36 GP-37 GP-39 GP-59 GP-61	60
32	Materials and Installed Equipment Timely Availability at an Acceptable Price Difficulty in Determining Whether a Particular Brand Meets Specifications	{ GP-5 GP-3 -	62
33	Equipment Timely Availability at an Acceptable Price Productivity/Breakdowns	- -	64
34	Contractor's Management and Supervision	GP-11	65
35	Subcontractors	GP-5	66
36	Energy	-	67

RISK FACTORS*

1. Limited Time and Funding for Design and Subsurface Investigation

Risk: Quick, inexpensive design may actually increase total project costs.

GP: None

Risk Assumed by: Owner

Comments:

Subsurface: The designer may be in a better position than the contractor to investigate subsurface conditions because of the limited time allowed for bidding.

Design: Reduced time and funding results in a less cost-effective design. The designer does not have the time to adequately consider alternatives and check his work.

Contractor: The more complete the information given to the contractor, the less contingency he may feel he should include.

Trade-Offs: Time is money. During an inflationary period additional design time may not compensate for the cost increases due to delay. There may also be strong pressure to complete the project by the beneficial occupancy date.

* To accurately correlate risk factor and subject, refer to the index on pp 22 to 24.

2. Design Errors: Conflicts, Omissions, Interferences

Risk: Design errors and inadequate checking of plans may cause an increase in total project costs.

GP: GP-3d Changes

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any order, an equitable adjustment shall be made and the contract modified in writing accordingly:

Risk Assumed by: Owner

Comments:

If the contractor perceives errors, he may alter his bid to take advantage of the error and thus defeat the purpose of competitive bidding.

The contractor's perception of delays resulting from design errors and the timeliness of reimbursements may influence his contingency.

3. Constructibility: Innovative Versus Traditional Design

Risk: Unusual designs may require special materials, formwork, or installation processes which may make it abnormally difficult to determine the productivity estimate.

GP: None

Risk Assumed by: Contractor

Comments:

The contractor bears the risk of productivity. However, if some aspect of the design is impossible to construct, the owner will be responsible under the GP-3d Change clause concerning defective specifications:

That in the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with such defective specifications.

4. Plans and Specifications

Materials and Installed Equipment

Risk: Insufficient time is allowed for the contractor to determine which materials or installed equipment may be used within an "or equal" clause or for the contractor to locate nonstandard items that are specified. If he does not guess correctly on nonstandard items or on some nonspecified products being approved, his bids may not be competitive. If he is wrong, he incurs a loss.

GP: GP-9 Material and Workmanship

(a) Unless otherwise specifically provided in this contract, all equipment, material, and articles incorporated in the work covered by this contract are to be new and of the most suitable grade for the purpose intended. Unless otherwise specifically provided in this contract, reference to any equipment, material, article, or patented process, by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition, and the Contractor may, at his option, use any equipment, material, article, or process which, in the judgment of the Contracting Officer, is equal to that named. The Contractor shall furnish to the Contracting Officer for his approval the name of the manufacturer, the model number, and other identifying data and information respecting the performance, capacity, nature, and rating of the machinery and mechanical and other equipment which the Contractor contemplates incorporating in the work. When required by this contract or when called for by the Contracting Officer, the Contractor shall furnish the Contracting Officer for approval full information concerning the material or articles which he contemplates incorporating in the work. When so directed, samples shall be submitted for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles installed or used without required approval shall be at the risk of subsequent rejection.

Risk Assumed by: Contractor

Contradictory Clauses

Risk: The contractor may follow either the plans or specifications only to find that they are contradicted elsewhere; the contracting officer may decide that the one which the contractor followed is not in fact the one that governs.

GP: GP-2 Specifications and Drawings

Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy either in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at his own risk and expense.

Risk Assumed by: Contractor

Defective Specifications

Risk: Some task may be impossible to perform as specified. The contractor may incur expenses before the impossibility is apparent.

GP: GP-3d Changes

That in
the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with such defective specifications.

Risk Assumed by: Owner

5. Limited Contractor Time for Bid Preparation and Site Investigation

Risk: Because of time limitations, the contractor may not be able to conduct an adequate site investigation, investigate the availability of on-site and off-site land for temporary facilities, or compile adequate subcontractor and supplier bids. The contractor must then base his bid on more assumptions than would be necessary were more time allowed. The contractor faces the risk of being too conservative and not being competitive or being too optimistic and losing money by bidding too low.

GP: GP-13 Conditions Affecting the Work

The Contractor shall be responsible for having taken steps reasonably necessary to ascertain the nature and location of the work, and the general and local conditions which can affect the work or the cost thereof. Any failure by the Contractor to do so will not relieve him from responsibility for successfully performing the work without additional expense to the Government.

GP: GP-48 Site Investigation

The Contractor acknowledges that he has investigated and satisfied himself as to the conditions affecting the work, including but not restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, river stages, tides or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during prosecution of the work. The Contractor further acknowledges that he has satisfied himself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from information presented by the drawings and specifications made a part of this contract. Any failure by the Contractor to acquaint himself with the available information will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the work. The Government assumes no responsibility for any conclusions or interpretations made by the Contractor on the basis of the information made available by the Government.

Risk Assumed by: Contractor

Comments:

The number of sets of plans available is generally insufficient for all the contractors, subcontractors, and suppliers to make their take-offs in the limited time allowed.

There is sufficient time to analyze subcontractor and supplier bids, perhaps partly a result of anticipated bid shopping.

Because of time restrictions, the owner may be in a better position to provide more subsurface information. By doing so he could avoid duplication of costs by several contractors.

6. Estimating, Planning and Scheduling, and Bid Preparation Errors

Judgment Errors, Interpretation Errors, Omissions

Risk: Errors and omissions may cause the contractor's bid to be too high so that he is noncompetitive or too low so that he may lose money.

GP: None

Risk Assumed by: Contractor* without additional cost to owner

Comments:

The commission of these errors by the contractor may be due in part to confusing plans and specifications.

Mistake

Risk: A mistake may cause the contractor's bid to be too low so that he loses money or too high so that he is not the low bidder.

GP: None

Risk Assumed by: Owner does not assume the risk. Contractor may or may not, depending on the type of mistake, the time of discovery, and the effect of allowing reformation.

Comments:

Possible remedies are rescission and reformation.

* Except for certain cases involving mistakes.

7. Estimating, Planning and Scheduling Forecasts

Distance to Project from Contractor's Home Office

Risk: If the site is in an area with which the contractor is unfamiliar, he may be exposed to the uncertainties of dealing with new suppliers, labor, subcontractors, inspectors, political jurisdictions, etc.

GP: GP-13 Conditions Affecting the Work

The Contractor shall be responsible for having taken steps reasonably necessary to ascertain the nature and location of the work, and the general and local conditions which can affect the work or the cost thereof. Any failure by the Contractor to do so will not relieve him from responsibility for successfully performing the work without additional expense to the Government.

Risk Assumed by: Contractor

Uncertainty in Productivity Forecasts

Risk: It is extremely difficult to forecast productivities for subsurface work, labor-intensive work, or weather-dependent work. If productivity forecasts are too high, cost overruns will occur; if they are too low, the bid will not be competitive.

GP: None

Risk Assumed by: Contractor, unless resulting from factors such as differing site conditions or other than normal weather.

Uncertainty in Scheduling

Risk: Schedules are based on uncertain productivities and do not always adequately consider the timely availability and coordination of subcontractors and suppliers with the general contractor or with each other. The result may be cost overruns and liquidated damages incurred by the contractor or not getting the job if the bid is too conservative.

GP: None

Risk Assumed by: Contractor

Comments:

Coordination of subcontractors and suppliers can be a complex problem since in the peak of the construction season they are also busy on other jobs.

Delivery times for nonstandard items may be difficult to estimate.

Normal weather effects must be considered in scheduling. However, other than normal weather effects will be addressed separately.

8. Competitive Environment

Local Construction Economy

Risk: The more depressed the local market, the more competitive the contractors', subcontractors', and suppliers' bids will be. In less competitive times, the owner has the option of rejecting all bids and waiting for more competitive times. The contractor faces the alternatives of being competitive or not getting work. The owner who decides to wait faces the risk that bids will not become more competitive in the near future.

GP: None

Risk Assumed by: Owner and contractor

Number of Bidders

Risk: The greater the number of bidders, the more competitive the bids. As the number of bidders increases, contractors face the risk of becoming more competitive or not getting work. Owners have the option of rejecting all bids if there are too few bidders.

GP: None

Risk Assumed by: Owner and contractor

9. Contractor's Values

Risk: A low-bidding contractor may try to improve his profits by gouging on change orders and submitting numerous small claims. In such a case, it might have been more advantageous for the owner not to accept the low bid if the contractor's integrity is questionable. Entering a contract with a questionable low bidder may cost more than accepting a higher bid from a contractor known for his pride, reputation, and integrity.

GP: None

Risk Assumed by: Owner

Comments:

Firm-fixed-price contracts are generally awarded to the lowest responsible bidder. In public construction, a contractor who passes the bonding requirements and submits the lowest bid is practically assured of being awarded the job despite his reputation.

10. Contract Administration

Owner's Timely Performance of Decision Making and Approvals

Risk: During the construction process a delay while waiting for an owner's approval can cause a costly disruption. If the contractor goes ahead without approval, his work may be rejected. If he waits, he may incur cost overruns.

GP: GP-9 Material and Workmanship

Machinery, equipment, material, and articles installed or used without required approval shall be at the risk of subsequent rejection.

GP-15 Shop Drawings

The Contracting Officer will indicate his approval or disapproval of the shop drawings and if not approved as submitted shall indicate his reasons therefor. Any work done prior to such approval shall be at the Contractor's risk. Approval by the Contracting Officer

Risk Assumed by: Contractor

Owner's Versus Contractor's Perception of Contractor's Responsibilities

Risk: If the owner's and contractor's perception of the contractor's responsibilities are different, conflict may result. Both owner and contractor are exposed to costly disputes or litigation.

GP: None

Risk Assumed by: Owner and contractor

11. Degree of Inspection for Compliance

Familiarity with Interpretation of Specifications

Risk: If the contractor is not familiar with procedures or interpretations, he may find that he must do something he had not planned on without receiving any additional compensation.

GP: None

Risk Assumed by: Contractor

Familiarity With Inspection Procedures

Risk: The contracting officer may require much more testing and inspection than is normally expected, resulting in increased costs and delays for the contractor.

GP: GP-10 Inspection and Acceptance

(a) All work (which term includes but is not restricted to materials, workmanship, and manufacture and fabrication of components) shall be subject to inspection and test by the Government at all reasonable times and at all places prior to acceptance. Any such inspection and test is for the sole benefit of the Government and shall not relieve the Contractor of the responsibility of providing quality control measures to assure that the work strictly complies with the contract requirements. No inspection or test by the Government shall be construed as constituting or implying acceptance. Inspection or test shall not relieve the Contractor of responsibility for damage to or loss of the material prior to acceptance.

(d) The Contractor shall furnish promptly, without additional charge, all facilities, labor, and material reasonably needed for performing such safe and convenient inspection and test as may be required by the Contracting Officer.

GP: GP-41 Contractor Inspection System

The Contractor shall (i) maintain an adequate inspection system and perform such inspections as will assure that the work performed under the contract conforms to contract requirements, and (ii) maintain and make available to the Government adequate records of such inspections.

Risk Assumed by: Contractor

12. Changes in Owner's Requirements for Facility

Risk: If the contractors perceive that significant changes will be made, they must decide whether to bid as specified or try to anticipate how the changes will affect such factors as their indirect costs and productivities. The adjustments they make for those anticipated effects may or may not be adequate.

GP: GP-3 Changes

(a) The Contracting Officer may, at any time, without notice to the sureties, by written order designated or indicated to be a change order, make any change in the work within the general scope of the contract, including but not limited to changes:

- (i) in the specifications (including drawings and designs);
- (ii) in the method or manner of performance of the work;
- (iii) in the Government-furnished facilities, equipment, materials, services, or site; or
- (iv) directing acceleration in the performance of the work.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any order, an equitable adjustment shall be made and the contract modified in writing accordingly.

Risk Assumed by: Owner, the contractor faces possibility of unfavorable settlement.

13. Shop Drawings

Risk: Even though the contracting officer approves shop drawings, the contractor retains the risk of noncompliance. The contractor may feel that he has complied with the specifications and has obtained the appropriate shop drawing approval only to find out after completing the work that it does not comply.

GP: GP-15 Shop Drawings

(b) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate his approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate his approval or disapproval of the shop drawings and if not approved as submitted shall indicate his reasons therefor. Any work done prior to such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (c) below.

(c) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation(s), he shall issue an appropriate contract modification, except that, if the variation is minor and does not involve a change in price or in time of performance, a modification need not be issued.

Risk Assumed by: Contractor

14. Changes in Costs

Risk: Changes in the rate of inflation and price escalation may significantly change the contractor's actual costs for the project compared to his estimate.

GP: None

Risk Assumed by: Contractor

15. Basis for Determination of Costs

Risk: When changes are made to the contract, equitable adjustments for compensation must be determined. There is much room for interpretation in determining equitable costs. The resulting settlement may be unfair to either the contractor or the owner.

GP: None

Risk Assumed by: Owner and contractor

Comments:

General factors such as the following influence the determination of equitable compensation:

- a. Reasonableness
- b. Allocability
- c. Application of generally accepted accounting principles and practices
- d. Limitations or exclusions as to types or amounts of specific cost items.

Specific factors such as the following should be considered:

- a. Judgmental cost factors
- b. Impact cost on unchanged work
- c. Interest
- d. Inflation and price escalation
- e. Ability of the negotiator.

16. Disputes

Risk: It costs both the contractor and owner time and money to go through the procedure for resolving disputes. The risk to the contractor is that if he files a claim, he will incur costs and may not win. The risk to the owner is that if he is not fair to the contractor he may lose and have to pay interest on the claim.

GP: GP-6 Disputes

(a) Except as otherwise provided in this contract, any dispute concerning a question of fact arising under this contract which is not disposed of by agreement shall be decided by the Contracting Officer, who shall reduce his decision to writing and mail or otherwise furnish a copy thereof to the Contractor. The decision of the Contracting Officer shall be final and conclusive unless, within 30 days from the date of receipt of such copy, the Contractor mails or otherwise furnishes to the Contracting Officer a written appeal addressed to the head of the agency involved. The decision of the head of the agency or his duly authorized representative for the determination of such appeals shall be final and conclusive. This provision shall not be pleaded in any suit involving a question of fact arising under this contract as limiting judicial review of any such decision to cases where fraud by such official or his representative or board is alleged: *Provided, however,* that any such decision shall be final and conclusive unless the same is fraudulent or capricious or arbitrary or so grossly erroneous as necessarily to imply bad faith or is not supported by substantial evidence. In connection with any appeal proceeding under this clause, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of his appeal. Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the contract and in accordance with the Contracting Officer's decision.

(b) This "Disputes" clause does not preclude consideration of questions of law in connection with decisions provided for in paragraph (a) above. Nothing in this contract, however, shall be construed as making final the decision of any administrative official, representative, or board on a question of law.

GP-19 Payment of Interest on Contractor's Claims

(a) If an appeal is filed by the Contractor from a final decision of the Contracting Officer under the DISPUTES clause of this contract, denying a claim arising under the contract, simple interest on the amount of the claim finally determined owed by the Government shall be payable to the Contractor.

Risk Assumed by: Owner and contractor

Comments:

Questions of fact are decided by the contracting officer or head of the agency or his duly appointed representative. As a result, there may be some bias against the contractor. Questions of law are not subject to this procedure.

**17. Termination for Default, Damages
for Delay, and Time Extensions**

Risk: If the contractor fails to prosecute the work with such diligence as will insure its completion on time, the Government may terminate the contractor's right to proceed with the work unless the delay arises from causes other than normal weather beyond the control and without the fault or negligence of the contractor. If the contractor falls behind schedule, he risks termination of the contract and he may be assessed damages. From the owner's viewpoint, this risk may be covered by a performance bond. The owner's risk is that his project may not be completed on time, and he will receive no compensation if the delay is not the contractor's fault. The contractor's risk is that he will not receive additional compensation except for unreasonable delays which are owner caused. The contractor may be allowed time extensions for certain types of delay.

GP: GP-5 Termination for Default--Damages for Delay--Time Extensions

- (a) If the Contractor refuses or fails to prosecute the work, or any separable part thereof, with such diligence as will insure its completion within the time specified in this contract, or any extension thereof, or fails to complete said work within such time, the Government may, by written notice to the Contractor, terminate his right to proceed with the work or such part of the work as to which there has been delay. In such event the Government may take over the work and prosecute the same to completion, by contract or otherwise, and may take possession of and utilize in completing the work such materials, appliances, and plant as may be on the site of the work and necessary therefor. Whether or not the Contractor's right to proceed with the work is terminated, he and his sureties shall be liable for any damage to the Government resulting from his refusal or failure to complete the work within the specified time.
- (b) If fixed and agreed liquidated damages are provided in the contract and if the Government so terminates the Contractor's right to proceed, the resulting damage will consist of such liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.
- (c) If fixed and agreed liquidated damages are provided in the contract and if the Government does not so terminate the Contractor's right to proceed, the resulting damage will consist of such liquidated damages until the work is completed or accepted.
- (d) The Contractor's right to proceed shall not be so terminated nor the Contractor charged with resulting damage if:
 - (1) The delay in the completion of the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the Government in either its sovereign or contractual capacity, acts of another Contractor in the performance of a contract with the Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and such subcontractors or suppliers;
 - (e) If, after notice of termination of the Contractor's right to proceed under the provisions of this clause, it is determined for any reason that the Contractor was not in default under the provisions of this clause, or that the delay was excusable under the provisions of this clause, the rights and obligations of the parties shall, if the contract contains a clause providing for termination for convenience of the Government, be the same as if the notice of termination had been issued pursuant to such clause. If, in the foregoing circumstances, this contract does not contain a clause providing for termination for convenience of the Government, the contract shall be equitably adjusted to compensate for such termination and the contract modified accordingly; failure to agree to any such adjustment shall be a dispute concerning a question of fact within the meaning of the clause of this contract entitled "Disputes".

Risk Assumed by: Owner and contractor

18. Financial Aspects

Cash Flow: Progress Payments, Retainages, and Separate Payment for Mobilization and Demobilization Costs

Risk: The contractor may risk short-run default because of cash-flow problems. The determination of the value of the work placed and the amount of retainage from progress payments will affect the contractor's cash flow. The timely receipt of progress payments is essential. Separate payment of mobilization and demobilization costs will relieve the contractor of financing these operations. The contracting officer can exercise a certain amount of discretion in deciding whether to pay the contractor more often than monthly and in whether or not to retain a portion of the payment beyond 50 percent completion, or beyond substantial completion. The contractor incurs a risk if he assumes when bidding that the payment schedule will be more favorable and timely than it turns out to be in fact. The Government incurs the risk of the contracting officer overpaying the contractor. Government laxity in reviewing and settling claims in a timely manner, or delays in making a final acceptance, may also adversely affect the contractor's cash flow.

GP: GP-7 Payments to Contractor

(b) The Government will make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates approved by the Contracting Officer. If requested by the Contracting Officer, the Contractor shall furnish a breakdown of the total contract price showing the amount included therein for each principal category of the work, in such detail as requested, to provide a basis for determining progress payments. In the preparation of estimates the Contracting Officer, at his discretion, may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site may also be taken into consideration (1) if such consideration is specifically authorized by the contract and (2) if the Contractor furnishes satisfactory evidence that he has acquired title to such material and that it will be utilized on the work covered by this contract.

(c) In making such progress payments, there shall be retained 10 percent (10%) of the estimated amount until final completion and acceptance of the contract work. However, if the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, he may authorize such payment to be made in full without retention of a percentage. Also, whenever the work is substantially complete, the Contracting Officer shall retain an amount he considers adequate for the protection of the Government and, at his discretion, may release to the Contractor all or a portion of any excess amount.

Risk Assumed by: Owner and contractor

Continuation of Funding

Risk: If the owner terminates the project, the contractor risks being unable to get another job or receive a termination settlement which he feels is fair.

GP: GP-18 Termination for Convenience of the Government-Construction

(a) The performance of work under this contract may be terminated by the Government in accordance with this clause in whole, or from time to time in part, whenever the Contracting Officer shall determine that such termination is in the best interest of the Government. Any such termination shall be effected by delivery to the Contractor of a Notice of Termination specifying the extent to which performance of work under the contract is terminated, and the date upon which such termination becomes effective.

(c) After receipt of a Notice of Termination, the Contractor shall submit to the Contracting Officer his termination claim, in the form and with certification prescribed by the Contracting Officer.

Risk Assumed by: Contractor

Risk Assumed by: Owner and contractor

Continuation of Funding

19. Permits, Licenses, and Patents

Permits and Licenses

Risk: The contractor is responsible for obtaining and paying for any necessary licenses and permits and for complying with any applicable laws, codes, and regulations. The contractor risks not being able to obtain these permits within a reasonable time after he has been awarded the job.

GP: GP-12 Permits and Responsibilities

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any applicable Federal, State, and municipal laws, codes, and regulations, in connection with the prosecution of the work.

Comments:

To avoid delays and to determine whether or not some of the permits can be obtained at all, it may be more appropriate for the owner to obtain them.

Patents

Risk: The contractor agrees to indemnify the owner against any liability for infringement upon any letters patent of the United States. The contractor risks violating a patent in the performance of the contract and being held responsible for it.

GP: GP-21 Patent Indemnity

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and employees against liability, including costs and expenses, for infringement upon any Letters Patent of the United States (except Letters Patent issued upon an application which is now or may hereafter be, for reasons of national security, ordered by the Government to be kept

secret or otherwise withheld from issue) arising out of the performance of this contract or out of the use or disposal by or for the account of the Government of supplies furnished or construction work performed hereunder.

Risk Assumed by: Contractor

20. Taxes

Risk: A change in any Federal excise tax or duty on the transactions or property of the contract may go into effect after the contract date. The owner incurs the cost if taxes go up, and the contractor absorbs the decrease in contract price if taxes go down.

GP: GP-31 Federal, State, and Local Taxes

(a) Except as may be otherwise provided in this contract, the contract price includes all applicable Federal, State, and local taxes and duties.

(b) Nevertheless, with respect to any Federal excise tax or duty on the transactions or property covered by this contract, if a statute, court decision, written ruling, or regulation takes effect after the contract date, and—

(1) results in the Contractor being required to pay or bear the burden of any such Federal excise tax or duty or increase in the rate thereof which would not otherwise have been payable on such transactions or property, the contract price shall be increased by the amount of such tax or duty or rate increase, *provided* the Contractor warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price as a contingency reserve or otherwise; or

(2) results in the Contractor not being required to pay or bear the burden of, or in his obtaining a refund or drawback of, any such Federal excise tax or duty which would otherwise have been payable on such transactions or property or which was the basis of an increase in the contract price, the contract price shall be decreased by the amount of the relief, refund, or drawback, or that amount shall be paid to the Government, as directed by the Contracting Officer. The contract price shall be similarly decreased if the Contractor, through his fault or negligence or his failure to follow instructions of the Contracting Officer, is required to pay or bear the burden of, or does not obtain a refund or drawback of, any such Federal excise tax or duty.

Risk Assumed by: Owner and contractor

21. Additional Bond Security

Risk: If in the opinion of the contracting officer any surety upon any bond furnished becomes unacceptable to the owner, the contractor may be required to furnish additional security. The question of whether a surety has become unacceptable is open to varying interpretations. The contractor risks being unable to find another surety if necessary during the course of a project that is not going well.

GP: GP-22 Additional Bond Security

If any surety upon any bond furnished in connection with this contract becomes unacceptable to the Government, or if any such surety fails to furnish reports as to his financial condition from time to time as requested by the Government, or if the contract price is increased to such an extent that the penal sum of any bond becomes inadequate in the opinion of the Contracting Officer, the Contractor shall promptly furnish such additional security as may be required from time to time to protect the interests of the Government and of persons supplying labor or materials in the prosecution of the work contemplated by this contract.

Risk Assumed by: Contractor

22. Liability Losses

Risk: The contractor is responsible for all damages to persons or property that occur as a result of his fault or negligence.

GP: GP-12 Permits and Responsibilities

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any applicable Federal, State, and municipal laws, codes, and regulations, in connection with the prosecution of the work. He shall be similarly responsible for all damages to persons or property that occur as a result of his fault or negligence. He shall take proper safety and health precautions to protect the work, the workers, the public, and the property of others. He shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire construction work, except for any completed unit of construction thereof which theretofore may have been accepted.

Risk Assumed by: Contractor

Comments:

This risk is traditionally covered by bodily-injury and property-damage insurance.

23. Damages and Delays to Project
During Construction

Risk: Materials delivered to the site or work already performed may be damaged through no fault of the contractor. Unless the work has previously been accepted, the contractor is responsible (except for certain causes of damage as noted in GP-5).

GP: GP-12 Permits and Responsibilities

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any applicable Federal, State, and municipal laws, codes, and regulations, in connection with the prosecution of the work. He shall be similarly responsible for all damages to persons or property that occur as a result of his fault or negligence. He shall take proper safety and health precautions to protect the work, the workers, the public, and the property of others. He shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire construction work, except for any completed unit of construction thereof which theretofore may have been accepted.

GP-5 Termination for Default--Damages for Delay--Time Extensions

(d) The Contractor's right to proceed shall not be so terminated nor the Contractor charged with resulting damage if:

(1) The delay in the completion of the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the Government in either its sovereign or contractual capacity, acts of another Contractor in the performance of a contract with the Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and such subcontractors or suppliers;

Risk Assumed by: The contractor assumes the risk of dollar costs for damages and delays; the owner may assume the risk for time extensions in certain cases, as noted in GP-5.

24. Contractor Failure to Enter Into Contract

Risk: The contractor to whom the owner would like to award the contract may not wish to sign a contract at the price he originally bid. The owner may incur costs through delays in starting the project.

GP: None

Risk Assumed by: Contractor

Comments:

The owner usually requires a bid bond to encourage the contractor to sign at his bid price.

25. Nonpayment of Creditors

Risk: Under the doctrine of sovereign immunity the Government is immune from liens on a construction project. In private construction, laborers, subcontractors, and suppliers can often use liens to obtain payment for their work. To protect these laborers and material suppliers and to reduce the risk of nonpayment, the Government requires a payment bond on any contract exceeding \$2000.

GP: None

Risk Assumed by: Contractor

26. Interferences from Acts of Owners

Other Contracts

Risk: The owner may have awarded other contracts which may create extra coordination and interference problems resulting in delays and increased costs to the contractor. The contractor may receive a time extension under GP-5.

GP: GP-14 Other Contracts

The Government may undertake or award other contracts for additional work, and the Contractor shall fully cooperate with such other contractors and Government employees and carefully fit his own work to such additional work as may be directed by the Contracting Officer. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other contractor or by Government employees.

GP-5 Termination for Default--Damages for Delay--Time Extensions

(d) The Contractor's right to proceed shall not be so terminated nor the Contractor charged with resulting damage if:

(1) The delay in the completion of the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the Government in either its sovereign or contractual capacity, acts of another Contractor in the performance of a contract with the Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and such subcontractors or suppliers;

Risk Assumed by: The contractor assumes the cost risk; the owner may assume the time extension.

Use and Possession Prior to Completion

Risk: The owner has the right to take possession and use any completed or partially completed part of the work. As a result, the contractor may be delayed or incur increased costs. If such possession by the owner causes the contractor additional expenses or time, an equitable adjustment will be made.

GP: GP-16 Use and Possession Prior to Completion

The Government shall have the right to take possession of or use any completed or partially completed part of the work. Prior to such possession or use, the Contracting Officer shall furnish the Contractor an itemized list of work remaining to be performed or corrected on such portions of the project as are to be possessed or used by the Government, provided that failure to list any item of work shall not relieve the Contractor of responsibility for compliance with the terms of the contract. Such possession or use shall not be deemed an acceptance of any work under the contract. While the Government has such possession or use, the Contractor, notwithstanding the

provisions of the clause of this contract entitled "Permits and Responsibilities," shall be relieved of the responsibility for the loss or damage to the work resulting from the Government's possession or use. If such prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment in the contract price or the time of completion will be made and the contract shall be modified in writing accordingly.

Risk Assumed by: Owner

Suspension of Work

Risk: The contracting officer may suspend work. If the suspension is for an unreasonable period of time, an equitable adjustment will be made.

GP: GP-17 Suspension of Work

(a) The Contracting Officer may order the Contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as he may determine to be appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted by an act of the Contracting Officer in the administration of this contract, or by his failure to act within the time specified in this contract (or if no time is specified, within a reasonable time), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by such unreasonable suspension, delay, or interruption and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent (1) that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor or (2) for which an equitable adjustment is provided for or excluded under any other provision of this contract.

Risk Assumed by: Contractor

Comment:

From the contractor's viewpoint, any work stoppage is for an unreasonable period of time. He is exposed to risk in that the period of stoppage may not be found to be unreasonable even though the contractor incurs costs from the delay.

27. Differing Site Conditions

Risk: Contractors are asked to base their bids on the physical conditions represented by the plans and specifications and those which would ordinarily be encountered. The clause concerning differing site conditions is intended to facilitate modifications when the physical conditions differ and affect the cost of the work. Without such a clause, contractors would be forced to add large contingencies for the unknown. With it, owners accept the risk of cost changes due to differing site conditions.

GP: GP-4 Differing Site Conditions

(a) The Contractor shall promptly, and before such conditions are disturbed, notify the Contracting Officer in writing of: (1) subsurface or latent physical conditions at the site differing materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in this contract. The Contracting Officer shall promptly investigate the conditions, and if he finds that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the work under this contract, whether or not changed as a result of such conditions, an equitable adjustment shall be made and the contract modified in writing accordingly.

Risk Assumed by: Owner

28. Normal Weather Variations and
Seasonality Effects

Risk: The contractor agrees to complete the project for a fixed price within a specified time. Variations in weather which are not classified as unusually severe weather may cause delays and increase costs. These normal variations must be considered by the contractor.

GP: None

Risk Assumed by: Contractor

Comments:

Ten years is a common observation period for differentiating normal from other than normal weather.

29. Environmental Protection

Environmental Litigation

Risk: If the performance of the work is suspended or delayed because of a court order as a result of environmental litigation, and through no fault of the contractor, then an equitable adjustment will be made. The owner risks the increased costs resulting from such a delay. Cancellation of the project will result in the loss of any funds previously expended without obtaining any benefits.

GP: GP-73 Environmental Litigation (applicable only to civil works construction and civil and military dredging contracts)

(a) If the performance of all or any part of the work is suspended, delayed, or interrupted due to an order of a court of competent jurisdiction as a result of environmental litigation, as defined below, the Contracting Officer, at the request of the Contractor, shall determine whether the order is due in any part to the acts or omissions of the Contractor or a Subcontractor at any tier not required by the terms of this contract. If it is determined that the order is not due in any part to acts or omissions of the Contractor or a Subcontractor at any tier other than as required by the terms of this contract, such suspension, delay, or interruption shall be considered as if ordered by the Contracting Officer in the administration of this contract under the terms of the "Suspension of Work" clause of this contract. The period of such suspension, delay or interruption shall be considered unreasonable, and an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) as provided in that clause, subject to all the provisions thereof.

(b) The term "environmental litigation", as used herein, means a lawsuit alleging that the work will have an adverse effect on the environment or that the Government has not duly considered, either substantively or procedurally, the effect of the work on the environment. (ECI 7-671.10)

Risk Assumed by: Owner

Environmental Regulations

Risk: Noncompliance with regulations concerning such matters as waste disposal, fumes, dust, or noise exposes the contractor to the possibility of additional costs for compliance.

GP: GP-62 Clean Air and Water

(Applicable only if the contract exceeds \$100,000, or the Contracting Officer has determined that orders under an indefinite quantity contract in any one year will exceed \$100,000, or a facility to be used has been the subject of a conviction under the Clean Air Act (42 U.S.C. 1857c-8(c)(1)) or the Federal Water Pollution Control Act (33 U.S.C. 1319(c)) and is listed by EPA, or the contract is not otherwise exempt.)

(a) The Contractor agrees as follows:

- (i) to comply with all the requirements of section 114 of the Clean Air Act, as amended (42 U.S.C. 1857, et seq., as amended by Public Law 91-604) and section 308 of the Federal Water Pollution Control Act (33 U.S.C. 1251, as amended by Public Law 92-500), respectively, relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in section 114 and section 308 of the Air Act and the Water Act, respectively, and all regulations and guidelines issued thereunder before the award of this contract;
- (ii) that no portion of the work required by this prime contract will be performed in a facility listed on the Environmental Protection Agency List of Violating Facilities on the date this contract was awarded unless and until the EPA eliminates the name of such facility or facilities from such listing;
- (iii) to use his best efforts to comply with clean air standards and clean water standards at the facilities in which the contract is being performed; and

Risk Assumed by: Contractor

30. Health and Safety

Risk: The contractor bears responsibility for compliance with the provisions of both the Occupational Safety and Health Administration (OSHA), EM 385-1-1, General Safety Requirements Manual, and for the costs of accidents. Apparent conflict between these two documents and the possibility of varying interpretation of them may make compliance overly difficult.

GP: GP-12 Permits and Responsibilities

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any applicable Federal, State, and municipal laws, codes, and regulations, in connection with the prosecution of the work. He shall be similarly responsible for all damages to persons or property that occur as a result of his fault or negligence. He shall take proper safety and health precautions to protect the work, the workers, the public, and the property of others. He shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire construction work, except for any completed unit of construction thereof which theretofore may have been accepted.

GP-55 Accident Prevention

(a) In order to provide safety controls for protection to the life and health of employees and other persons; for prevention of damage to property, materials, supplies, and equipment; and for avoidance of work interruptions in the performance of this contract, the Contractor shall comply with all pertinent provisions of Corps of Engineers Manual, EM 385-1-1, dated 1 March 1967, entitled "General Safety Requirements", as amended, and will also take or cause to be taken such additional measures as the Contracting Officer may determine to be reasonably necessary for the purpose.

(b) The Contractor will maintain an accurate record of, and will report to the Contracting Officer in the manner and on the forms prescribed by the Contracting Officer, exposure data and all accidents resulting in death, traumatic injury, occupational disease, and damage to property, materials, supplies and equipment incident to work performed under this contract.

(c) The Contracting Officer will notify the Contractor of any noncompliance with the foregoing provisions and the action to be taken. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

Risk Assumed by: Contractor

31. Labor

Availability and Quality

Risk: The actual cost of labor and time required for labor to perform the work may vary significantly from the contractor's estimate, depending on the following factors:

Timely availability at an acceptable price

Productivity

Skill level

Union regulations/work rules/crew composition

Union versus nonunion personnel

Jurisdictional disputes

Crew coordination

Job condition factors.

GP: None

Risk Assumed by: Contractor

Strikes

Risk: Work stoppages due to strikes may increase the contractor's costs and lengthen the project duration. The contractor assumes the risk of increased costs. The owner assumes the risk of increased time by granting time extensions.

GP: GP-5 Termination for Default--Damages for Delay--Time Extensions

(d) The Contractor's right to proceed shall not be so terminated nor the Contractor charged with resulting damage if:

(1) The delay in the completion of the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the Government in either its sovereign or contractual capacity, acts of another Contractor in the performance of a contract with the Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and such subcontractors or suppliers;

Risk Assumed by: Owner and contractor

Socioeconomic Factors

Risk: Because of economic considerations, administrative problems, or oversights, the contractor faces a risk of noncompliance with regulations such as the following:

Equal Opportunity (GP-25)

Convict Labor (GP-28)

Davis-Bacon Act (GP-32)

Contract Work Hours and Safety Standards Act - Overtime Compensation (GP-33)

Apprentices and Trainees (GP-34)

Payrolls and Basic Records (GP-35)

Compliance with Copeland Regulations (GP-36)

Withholding of Funds (GP-37)

Contract Termination - Debarment (GP-39)

Affirmative Action for Disabled Veterans and Veterans of the Vietnam Era (GP-59)

Affirmative Action for Handicapped Workers (GP-61).

Risk Assumed by: Contractor

32. Materials and Installed Equipment

Timely Availability at an Acceptable Price

Risk: The contractor assumes the responsibility of furnishing the materials and installed equipment on time, and he absorbs the difference between his bid price and actual costs except as follows:

1. In cases of delays of suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of both the contractor and such subcontractors or suppliers, a time extension may be granted (see GP-5d).
2. In cases where the specified items are not available or discontinued and the specifications are found to be defective, an equitable adjustment for cost and time may be made (see GP-3d).

GP: GP-5d Termination for Default--Damages for Delay--Time Extensions

(d) The Contractor's right to proceed shall not be so terminated nor the Contractor charged with resulting damage if:

(1) The delay in the completion of the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the Government in either its sovereign or contractual capacity, acts of another Contractor in the performance of a contract with the Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and such subcontractors or suppliers;

GP-3d Changes

That in
the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with such defective specifications.

Risk Assumed by: Contractor, except (1) in certain cases of delays by suppliers, where the owner assumes the time delay and the contractor assumes the cost, and (2) in the case of defective specifications, where the owner assumes the risk.

*Difficulty in Determining Whether a
Particular Brand Meets Specifica-
tions*

See the discussion under "Plans and Specifications," No. 4.

33. Equipment

Timely Availability at an Acceptable Price

Risk: Arrangements made for renting, buying, or leasing equipment during the bid preparation stage may no longer be applicable because of changes in availability or cost.

GP: None

Risk Assumed by: Contractor

Productivity/Breakdowns

Risk: Variations in equipment productivity affect the cost and time required for performance. The risk of such productivity changes are assumed by the contractor unless they can be shown to result from differing site conditions (see No. 27).

GP: None

Risk Assumed by: Contractor

34. Contractor's Management and Supervision

Risk: The contractor must have personnel of sufficient quality and experience to manage the job and these personnel must not be overextended. The risk to the contractor is that the adequate management and supervision assumed in the estimates may not be available.

GP: GP-11 Superintendence by Contractor

The Contractor, at all times during performance and until the work is completed and accepted, shall give his personal superintendence to the work or have on the work a competent superintendent, satisfactory to the Contracting Officer and with authority to act for the Contractor.

Risk Assumed by: Contractor

35. Subcontractors

Risk: Timely availability of subcontractors at an acceptable price is assumed by the contractor. The risk to the contractor includes the problems of coordinating and scheduling the various subcontractors so as to minimize conflicts and delays. The subcontractors may also be working on other jobs and it may be difficult to get them at the time needed. The contractor assumes responsibility for the cost of these delays. If the delay of the subcontractor arises from unforeseeable causes beyond the control and without the fault or negligence of both the contractor and the subcontractor, a time extension may be granted by the owner.

GP: GP-5 Termination for Default--Damages for Delay--Time Extensions

(d) The Contractor's right to proceed shall not be so terminated nor the Contractor charged with resulting damage if:

(1) The delay in the completion of the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the Government in either its sovereign or contractual capacity, acts of another Contractor in the performance of a contract with the Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and such subcontractors or suppliers;

Risk Assumed by: Contractor, except in certain cases of delay where the owner assumes the risk of time delays (see GP-5 above).

36. Energy

Risk: The timely availability of temporary and permanent utilities at an acceptable price is essential if the contractor is to avoid delays and cost overruns.

GP: None

Risk Assumed by: Contractor

Comments:

In certain cases where the contract provides for an allotment of fuel for the contractor the risk would be assumed by the owner.

The relocation of utilities is generally the contractor's responsibility unless the locations were not shown on the plans.

APPENDIX B:

COMPREHENSIVE BIBLIOGRAPHY

Baldwin, J. R., J. M. Manthei, H. Rothbart, and R. B. Harris, "Causes of Delay in Construction," *Journal of the Construction Division, ASCE*, Vol 97, No. C02, Proc. Paper 8501 (November 1971), pp 177-187.

Benjamin, N. B. H., *Competitive Bidding for Building Construction Contracts*, Technical Report No. 106 (The Construction Institute, Department of Civil Engineering, Stanford University, June 1969).

Benjamin, B. H. and T. W. Greenwald, "Simulating Effects of Weather on Construction," *Journal of the Construction Division, ASCE*, Vol 99, No. C01, Proc. Paper 9888 (July 1973), pp 319-335.

Benson, L. and G. Colwell, *Contract Type Selection Guide for Construction Contracts*, Draft Report (U.S. Army Construction Engineering Research Laboratory [CERL], 1977).

Bjornsson, H. C., "Risk Analysis of Construction Cost Estimates," *Transactions of the American Association of Cost Engineers* (1977), pp 182-189.

Borg, R. F., "Changed Conditions Clause in Construction Contracts," *Journal of the Construction Division, ASCE*, Vol 90, No. C02 (September 1964), pp 37-48.

Borg, R. F., "Subsurface Construction Contracts - a Contractor's View," *Journal of the Construction Division, ASCE*, Vol 100, No. C04, Discussion (December 1974), pp 658-660.

Cantor, L., R. A. Rubin, and E. H. Goldberg, "Legal Aspects of Open Cut Construction," *Journal of the Construction Division, ASCE*, Vol 101, No. C04, Proc. Paper 11767 (December 1975), pp 923-934.

Carr, R. I., "Paying the Price for Construction Risk," *Journal of the Construction Division, ASCE*, Vol 103, No. C01, Proc. Paper 12827 (March 1977), pp 153-161.

Collins, Carroll J., "Impact: The Real Effect of Change Orders," *Transactions of the American Association of Cost Engineers* (1970), pp 188-191.

Committee on Contract Administration of The Construction Division, ASCE, "Who Pays for the Unexpected in Construction?", *Journal of the Construction Division, ASCE*, Vol 89, No. C02, Proc. Paper 3635, (September 1963), pp 23-58.

ASCE Committee on Contract Administration of The Construction Division, ASCE, "Who Pays for the Unexpected in Construction?", *Civil Engineering - ASCE*, Vol 33, No. 9 (September 1963), pp 37-39.

Contract Administration Manual, Section X, Exhibit B, "Time Extension Data." (Construction Division, Contract Administration Branch, U.S. Army Engineer District, Omaha, Corps of Engineers, 1975).

Currie, O. A. and M. J. Armour, "Common Pitfalls in Construction Contract Performance and Litigation - and How to Avoid Them," presented at 7-11 August 1977 American Bar Association Annual Meeting, Chicago, IL.

de Neufville, R., E. N. Hani, and Y. Lesage, "Bidding Models: Effects of Bidders' Risk Aversion," *Journal of the Construction Division, ASCE*, Vol 103, No. C01, Proc. Paper 12795 (March 1977), pp 57-70.

Deshmukh, S. S., "Risk Analysis," *Transactions of the American Association of Cost Engineers* (1976), pp 118-121.

Douglas, W. S., "Role of Specifications in Foundation Construction," *Journal of the Construction Division, ASCE*, Vol 100, No. C02, Proc. Paper 10570 (June 1974), pp 198-201.

Fox, G. A., "Subsurface Construction Contracts - A Contractor's View," *Journal of the Construction Division, ASCE*, Vol 100, No. C02, Proc. Paper 10608 (June 1974), pp 153-158.

Fox, G. A. and M. E. Greenberg, "Are Construction Contracts Fair?," *Civil Engineering - ASCE*, Vol 45, No. 5 (May 1975), pp 56-59.

Frisby, T. N., "Risk Management," presented at U.S. Army Engineer District Mobile Area and Resident Engineers Conference (21-23 July 1976), pp I-1-I-17.

Frisby, T. N., Sr., "Risk Management," *Civil Engineering - ASCE*, Vol 44, No. 5 (May 1974), p 94.

Gates, M., "Bidding Contingencies and Probabilities," *Journal of the Construction Division, ASCE*, Vol 97, No. C02, Proc. Paper 8524 (November 1971), pp 277-303.

Gates, M., "Bidding Strategies and Probabilities," *Journal of the Construction Division, ASCE*, Vol 93, No. C01, Proc. Paper 5159 (March 1967), pp 75-107.

Gates, M. and A. Scarpa, "Reward-Risk Ratio," *Journal of the Construction Division, ASCE*, Vol 100, No. C04, Proc. Paper 10984 (December 1974), pp 521-531.

General Safety Requirements Manual, EM 385-1-1 (Department of the Army, 1 June 1977).

Greenberg, M. E., "Role of Contract and Specifications in Foundations Construction," *Journal of the Construction Division, ASCE*, Vol 100, No. C02 (June 1974), pp 113-116.

Instructions for Preparation of Bidding Documents for Construction Contracts, Kansas City District, Corps of Engineers, Thirteenth Edition (January 1976).

Johnson, J., and O. E. Rood., *Elements of a Fair and Equitable Profit Determination for Construction Contract Negotiations*, Draft Report (U.S. Army Construction Engineering Research Laboratory [CERL], 1977).

Kraemer, G. T., "Meaningful Risk Assessment," *Transactions of the American Association of Cost Engineers* (1976), pp 127-132.

Marshall, C. W., "Quantification of Contractor Risk," *Naval Research Logistics Quarterly*, Vol 16, No. 4 (December 1969), pp 531-541.

Martell, R. E., "Simplifying Proof of Damages," presented at 7-11 August 1977, American Bar Association Annual Meeting, held at Chicago, IL.

Mason, G. E., *A Quantitative Risk Management Approach to the Selection of Construction Contract Provisions*, Technical Report No. 173 (The Construction Institute, Department of Civil Engineering, Stanford University, April 1973).

Modifications and Claims Guide: Fixed Price Construction Contracts, EP 415-1-2 (Department of the Army, Office of the Chief of Engineers, October 1976).

O'Brien, J. J., *Construction Delay: Responsibilities, Risks, and Litigation* (Cahners Books International, Inc., 1976).

Petro, J. J., "Contractor Defaults and Suretyship Made Simple," presented at 7-11 August, 1977, American Bar Association Annual Meeting, held at Chicago, IL.

Pouliquen, Louis Y., *Risk Analysis in Project Appraisal* (The Johns Hopkins Press, 1970).

Resident Engineers Management Guide, EP 415-1-260 Department of the Army, Office of Chief of Engineers, (October 1973).

Resident Engineer Manual for Construction Contract Modifications and Claims, Mobile District, Appendix R: "Time Extensions - for Delays Due to Weather Other Than Normal" (December 1976), pp R-1 - R-7.

Responsibility, Reliability, and Accountability for Risks in Construction, Proceeding of June 1977 conference (Technology Assessment and Utilization Program, Building Research Advisory Board, National Research Council [in publication]).

Rubin, R. A., "Construction Delays," presented at 7-11 August, 1977, American Bar Association Annual Meeting, held in Chicago, IL.

Rubin, R. A., "Fifty Years of Construction Law," *Journal of the Construction Division, ASCE*, Vol 101, No. C04, Proc. Paper 11758 (December 1975), pp 703-717.

Scott, D. F., "Effective Contract Administration in Construction Management," *Journal of the Construction Division, ASCE*, Vol 100, No. C02 (June 1974), pp 117-132.

Shafer, S. L., "Risk Analysis for Capital Projects Using Risk Elements," *Transactions of the American Association of Cost Engineers* (1974), pp 218-223.

Smith, S. E., W. W. Wilson, W. C. Burns, and R. A. Rubin, "Contractual Relationships in Construction," *Journal of the Construction Division, ASCE*, Vol 101, No. C04, Proc. Paper 11776 (December 1975), pp 907-921.

Sowers, G. F., "Changed Soil and Rock Conditions in Construction," *Journal of the Construction Division, ASCE*, Vol 97, No. C02, Proc. Paper 8509 (November 1971), pp 257-259.

U.S. National Committee on Tunneling Technology, "Better Contracting for Underground Construction," PB-236973 (National Academy of Sciences, November 1974).

Vergara, A. J. and L. T. Boyer, "Portfolio Theory: Applications in Construction," *Journal of the Construction Division, ASCE*, Vol 103, No. C01, Proc. Paper 12773 (March 1977), pp 23-38.

Vergara, A. J. and L. T. Boyer, "Probabilistic Approach to Estimating and Cost Control," *Journal of the Construction Division, ASCE*, Vol 100, No. C04, Proc. Paper 11021 (December 1974), pp 543-552.

Weston, R. J. and E. F. Brigham, *Managerial Finance* (Holt, Rinehart and Winston, Inc., 1972).

Wilson, W. W., "Past and Future of Contract Administration," *Journal of the Construction Division, ASCE*, Vol 101, No. C03, Proc. Paper 11560 (September 1975), pp 559-564.

Zeanah, P. H., "Advanced Techniques for Contingency Evaluation," *Transactions of the American Association of Cost Engineers* (1973), pp 68-75.

CERL DISTRIBUTION

USA Liaison Detachment
ATTN: Library
26 Federal Plaza
New York, NY 1007

US Military Academy
ATTN: Dept of Mechanics
ATTN: Library
West Point, NY 10996

Chief of Engineers
ATTN: DAEN-MCC-C (2)
ATTN: DAEN-ASI-L (2)
ATTN: DAEN-MCZ-S
ATTN: DAEN-RDL
Department of the Army
WASH DC 20314

Chief of Engineers
ATTN: DAEN-ZCP
Department of the Army
WASH DC 20310

Commander
ATTN: Learning Resources Center
ATTN: ATSE-TD-TL (2)
ATTN: Kingman Bldg, Library
Ft Belvoir, VA 22060

Commander
US Army Foreign Science and
Technical Center--Far East Office
APO San Francisco, CA 96328

Commander
US Army Foreign Science and
Technical Center
220 7th St, NE
Charlottesville, VA 22901

Defense Documentation Center
ATTN: TCA (12)
Cameron Station
Alexandria, VA 22314

Erickson, Carl A

Preliminary investigations of risk sharing in construction contracts / Carl A. Erickson, Michael J. O'Connor, Omar E. Rood. -- Champaign, Ill. : Construction Engineering Research Laboratory ; Springfield, Va : available from National Technical Information Service , 1978.

72 p. ; 27 cm. (Interim report - Construction Engineering Research Laboratory ; P-88)

1. Building - contracts and specifications. 2. Risk.
I. O'Connor, Michael J. II. Rood, Omar E. III. Title.
IV. Series: U.S. Construction Engineering Research
Laboratory. Interim report ; P-88.